Armstrong

Indian Corn

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INDIAN CORN

. . BY . .

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CONTENTS

INDIAN CORN

A large number of investigations in corn culture has been carried on by this and neighboring experiment stations and many practical questions have been answered. It seems as if there is no phase of this subject that has not been worked out to some extent. Some problems have been solved definitely while from investigations in other lines no conclusions can yet be drawn although the work has been continued for a number of years. Since this is the most important crop produced in the larger part of the state, it is wise to continue experiments and investigations along this line until details are so thoroughly worked out that the majority of farmers can raise maximum crops if they profit by the information thus obtained. While the following discussions do not settle anything they are given by one who is not prejudiced in favor of, nor against, any particular practice or theory. They cover briefly root pruning, cultivation, detasseling, suckers and barren stalks, and observations of the time of tasseling and silking.

ROOT PRUNING

The plots for this experiment were selected on the east side of my father's farm near Bondville, Ill. The seed, Chester's Leaming, had been planted about May 10, 1903 in the ordinary way and averaged a little over two stalks to the hill. The hills were

three and one half feet apart and there were forty hills in a row. As it was late in the spring before the experiment was undertaken all of the corn had been cultivated once. In plot II some of the rows were pruned once, some twice and some three times at the same depth and the same distance from the hill. The first pruning was done the second week in June, the second a week later and the third a week after the second. In plot I the pruning was done once only during the third week in June. The implements used were a pruning hoe for any depth up to six inches, and a wire or cutaway spade for eight and ten inches deep. The roots were cut on four sides of the hill except in rows 37 and 39 of plot II where they were cut on two sides at one time. It is very unusual for a man to cultivate as deep as six inches but the deep prunings were made to find out if possible which roots were the most necessary for the plant's growth. The corn was not cultivated after the experiment was started but the surface was loosened by the use of a triangular harrow and the weeds were kept down with a hoe.

It will be remembered that there was an unusually large amount of rainfall during the past summer. During the month of June the rainfall was 10.98 inches, in July 4.7 inches and in August 9.84 inches. The average amount during the last thirteen years for the month of June was 4.21 inches, for July 3.23 inches and for August 2.84 inches. As the extra supply of water fell during the season of growth, we can easily account for the small loss or no loss on some of the pruned rows. If the amount of rainfall had been small the roots could not have brought sufficient moisture from the deeper soil and the plant would have suffered from partial starvation. When a root is cut off it will not grow in length from the end, since the growing part is at the tip. The writer observed the ends of one or two roots a week after they

had been pruned, and found new growths starting from the sides near the end. There were as many as twenty rootlets within one inch of the end, varying from one-fourth to one and one-half inches in length some of which were greatly enlarged. It is a general observation that when roots of agricultural plants are cut or injured they send out more secondary roots or cause those already in existence to increase in size and length, thus making the root system more compact and confining it to a smaller amount of soil. These rootlets may be able to collect as much moisture and plant food as the whole root would have done if it had not been cut off, but as they do not go deep into the soil the plant would undoubtedly suffer on a dry year. It was my purpose to wash out the roots of a pruned and an unpruned hill for comparison but lack of time prevented this. This has, however, been done by others and the observations were as stated above.

The rows that were pruned two and four inches from the hill began to show the effect of the pruning within ten days. the upper leaves were pale instead of being a deep green and the lower leaves turned yellow. About the fourth of July the unpruned rows were apparently a foot taller than the pruned rows, although the height was not measured. Heavy rains followed, however, and when the corn had tasseled it was very difficult to tell by appearance which were pruned and which were not. In those pruned six, eight and ten inches deep there was no noticeable effect for about three weeks. In the middle of July the pruned rows had stalks shorter and more slender than the unpruned rows, and this difference was plain after tasseling. Later it was quite evident that the majority of the ears on the pruned rows would be small and this proved to be the case.

Before tasseling had begun the writer went through plot I

and the first eighteen rows of plot II, taking out the suckers and thinning so that each odd numbered row had the same number of stalks as the next even numbered row.

On July 18th, Mr. O. D. Center assisted in selecting representative hills from the rows pruned two and four inches from the hill, from those pruned six, eight and ten inches deep, and from unpruned rows next to them. Photographs of these were taken and they show quite plainly the effect of the injury to the roots.

The corn was harvested October 25th. All ears that were about seven inches long and were fairly well filled were called and all others were called poor ears. The following tables give the number of good and poor ears, the weight of good and poor ears, the total number of ears, the total weight, and the rate per acre.

Plot I (Pruned only once)

No. of row	Treatment	No. good ears	No. poor ears	Wt. of good ears	Wt. of poor ears	Total number	Total weight	Rate per acre (bu.)
1	Not pruned	41	15	[illegible].75	5.75	56	35	[illegible]
2	2 from hill 4 deep	41	14	30.5	5.25	55	35.75	41.[illegible]
3	Not pruned	45	16	35.5	5.5	61	41	47.0
4	2 from hill 4 deep	25	31	15	11.5	56	26.5	31
5	Not pruned	56	19	41.75	9	75	50.75	50.3
6	2 from hill 4 deep	44	32	30.25	15	76	45.25	52.9
7	Not pruned	57	10	42.5	9	73	51.5	60.3
8	4 from hill 4 deep	47	27	32	10.5	74	42.5	49.7
9	Not pruned	57	21	41	11.5	78	52.5	61.4
10	4 from hill 4 deep	55	23	37	11	76	48	56.1
11	Not pruned	54	26	40	15.5	80	55.5	65.5
12	4 from hill 4 deep	40	35	27.5	14.5	75	42	49.1
13	Not pruned	56	20	40	8	76	48	56.1
14	6 from hill 4 deep	58	23	35.5	13.5	81	49	57.3
15	Not pruned	50	23	41.5	8.5	73	50	58.5
16	6 from hill 4 deep	56	17	38	5	73	43	53.[illegible]
17	Not pruned	61	1[illegible]	45	5	73	50	53.8
18	8 from hill 4 deep	32	32	25.5	9.5	64	35	41.[illegible]
19	Not pruned	71	16	42.5	7.5	87	50	58.5
20	10 from hill 4 deep	38	33	37	14.5	72	41.5	48.5
21	Not pruned	58	19	41.5	14.5	77	56	62.1
22	10 from hill 4 deep	48	27	30	10	75	40	46.8
23	Not pruned	4[illegible]	35	30.5	8	78	38.5	45
24	10 from hill 4 deep	61	17	43	5	78	47	54.9
25	Not pruned	52	33	37.5	11.5	85	49	57.5
26	12 from hill 4 deep	58	17	49	8.5	75	57.5	67.3

Fig 1. Not pruned

Pruned 2 inches from the hill, 4 inches deep.

Plot I (corn)

Row No.	Treatment	No. good ears	No. poor ears	Wt. good ears	Wt. poor ears	Total	Total weight	[illegible]
27	Not pruned	57	1[illegible]	[illegible].5	7	[illegible]	55.5	[illegible]6.1
28	12 from hill 4 leav	53	17	[illegible]	10	70	51	[illegible].1
29	Not pruned	60	1[illegible]	[illegible]	7.5	71	53.[illegible]	66.1
30	12 from hill 4 leav	61	7	44.5	[illegible]	[illegible]	[illegible].5	66.[illegible]
31	Not pruned	65	21	53.5	5	[illegible]	44.5	62
32	6 from hill 2 leav	57	30	50.5	10	87	50.5	59
33	Not pruned	59	13	40	5	[illegible]	46	5[illegible].6
34	6 from hill 2 leav	53	35	44	7	88	53	62
35	Not pruned	61	24	40	10	85	50	58.5
36	6 from hill 2 leav	67	15	45	3	82	51	59.6
37	Not pruned	65	1[illegible]	[illegible].5	[illegible]	64	[illegible].5	56.7
38	6 from hill 6 leav	53	24	54	10	77	44	51.4
39	Not pruned	58	[illegible]	55	11.5	77	46.5	5[illegible].4
40	6 from hill 6 leav	41	36	[illegible]	14.5	77	41[illegible]	[illegible]7.[illegible]
41	Not pruned	4[illegible]	[illegible]	5[illegible].5	13	75	45.5	55.2
42	6 from hill 6 leav	46	25	50	10	71	40	46.[illegible]
43	Not pruned	56	[illegible]	40.5	[illegible].5	76	50	5[illegible].5
44	6 from hill 6 leav	40	41	2[illegible]	15	71	42	49.1
45	Not pruned	60	[illegible]	46	1[illegible]	77	56	55.5
46	6 from hill 6 leav	[illegible]	43	1[illegible]	1[illegible].5	7[illegible]	33.5	42.[illegible]
47	Not pruned	57	23	11	11.5	70	52.5	61.4
48	6 from hill [illegible] leav	32	45	1[illegible].5	20.5	7[illegible]	40	[illegible]6.2
49	Not pruned	67	23	47	10.5	90	5[illegible].5	67.8
50	6 from hill 10 leav	11	63	[illegible]	24	74	51	56.[illegible]
51	Not pruned	[illegible]	32	36	18.5	70	[illegible].5	48.7
52	6 from hill 10 leav	16	55	11.5	23	71	55.5	63.0
53	Not pruned	60	17	[illegible].5	3	77	57.5	67.2
54	6 from hill 10 leav	21	40	14.5	13.5	61	51	55.2

Fig 2. Not Pruned.

Pruned. 4 inches from [illegible]
[illegible] stalk.

Plot II ([illegible])

No. of row	Treatment	No. good ears	No. poor ears	Wt. good ears	Wt. poor ears	Total number	Total weight	Yield [illegible]
1	Three times	[illegible]	[illegible]	[illegible]	11.5	61	[illegible]	[illegible]
2	Not pruned	[illegible]	30	15.5	[illegible]	61	[illegible]	[illegible]
3	Three times	37	30	14	[illegible]	59	[illegible]	[illegible]
4	Not pruned	[illegible]	41	21	15.5	70	36.5	[illegible]
5	Three times	[illegible]	30	[illegible]	13	61	31	[illegible]
6	Not pruned	[illegible]	45	20.5	17	80	37.5	45.3
7	Two times	[illegible]	51	20.5	13	73	33.5	[illegible]
8	Not pruned	[illegible]	43	35	14	81	[illegible]	[illegible]
9	Two times	[illegible]	50	25	17	[illegible]	[illegible]	40.1
10	Not pruned	[illegible]	[illegible]	36.5	10	75	36.5	[illegible]
11	Two times	23	[illegible]	14	13.25	[illegible]	[illegible]	[illegible]
12	Not pruned	[illegible]	30	23.5	14	67	37.5	[illegible]
13	One time	36	35	23	[illegible]	71	[illegible]	[illegible]
14	Not pruned	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	One time	31	47	33	[illegible]	[illegible]	[illegible]	61.5
16	Not pruned	[illegible]	51	30.5	21	[illegible]	[illegible]	[illegible]
17	One time	[illegible]	[illegible]	35.5	13.5	[illegible]	[illegible]	[illegible]
18	Not pruned	43	36	[illegible]	13.5	[illegible]	[illegible]	[illegible]
19	Three times	[illegible]	[illegible]	37.5	[illegible]	[illegible]	[illegible]	[illegible]
20	Not pruned	[illegible]	45	[illegible]	17.5	[illegible]	43.5	[illegible]
21	Three times	47	35	[illegible]	11.5	[illegible]	[illegible]	[illegible]
22	Not pruned	60	23	30	[illegible]	83	47	54.0
23	Three times	59	25	35	6.5	[illegible]	[illegible]	[illegible]
24	Not pruned	[illegible]	34	[illegible]	12.5	[illegible]	51.5	[illegible]
25	Two times	57	35	35.5	13	[illegible]	[illegible]	56.7
26	Not pruned	56	46	35	[illegible]	102	54	65.1

Fig 3. Not Pruned. Pruned [illegible] inches [illegible] [illegible] inches deep.

[illegible] II (cont)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	Two times	35	31	36	12	36	[illegible]	[illegible]
28	Not pruned	53	[illegible]	36	10	[illegible]	46	[illegible]
29	Two times	57	34	[illegible]	[illegible]	41	45	[illegible]
30	Not pruned	[illegible]	[illegible]	[illegible]	12	[illegible]	44	61.4
31	One time	35	37	43	11.5	90	54.5	65.7
32	Not pruned	51	31	35	13.5	55	47.5	55.5
33	One time	45	35	[illegible]	14	76	43	[illegible]
34	Not pruned	61	36	40	10	[illegible]	50	[illegible]
35	One time	54	33	37.5	13.5	[illegible]	54	63.1
36	Not pruned	52	[illegible]	41.5	11.5	90	53	62
37	Three times 2 sides	[illegible]	30	39	11.5	57	50.5	[illegible]
38	Not pruned	57	34	47.5	[illegible]	91	56	55.5
39	Three times 2 sides	54	36	[illegible]	[illegible]	60	[illegible]	[illegible]
40	Not pruned	53	25	41.5	11	55	52.5	51.4

Fig. 4 Not Pruned Pruned 6 inches from the hill, 6 inches deep.

The following table may make the results a little clearer. It is obtained from the preceding by adding together the weights of corn produced on the rows that received the same treatment.

Rows	Treatment	Pounds	Rate per acre.
3	Not pruned	125.75	49.1
3	Pruned 2 from hill 4 deep	107.5	41.9
3	Not pruned	157.5	61.4
3	Pruned 4 from hill 4 deep	132.5	51.6
3	Not pruned	144	56
3	Pruned 6 from hill 4 deep	133	51.[illegible]
3	Not pruned	124.5	48.5
3	Pruned 10 from hill 4 deep	128.5	50
3	Not pruned	1[illegible]	65.1
3	Pruned 12 from hill 4 deep	130	52.6
3	Not pruned	13[illegible].5	54.[illegible]
3	Pruned 6 from hill 2 deep	154.5	60.[illegible]
3	Not pruned	140.5	54.7
3	Pruned 6 from hill 6 deep	125	4[illegible].7
3	Not pruned	15[illegible].5	61.[illegible]
3	Pruned 6 from hill 8 deep	11[illegible].5	[illegible]6.2
3	Not pruned	151.5	59
3	Pruned 6 from hill 10 deep	95.5	37.2
3	Pruned 6 from hill 4 deep 3 times	105.25	37.[illegible]
6	Not pruned	242.5	47.2
6	Pruned 6 from hill 4 deep 2 times	240.25	46.8
6	Not pruned	254	[illegible].5
6	Pruned 6 from hill 4 deep 1 time	271.5	52.9
6	Not pruned	263.75	51.[illegible]
2	Pruned 6 from hill 4 deep 2 sides	99	58.4
2	Not pruned	103.5	60.9

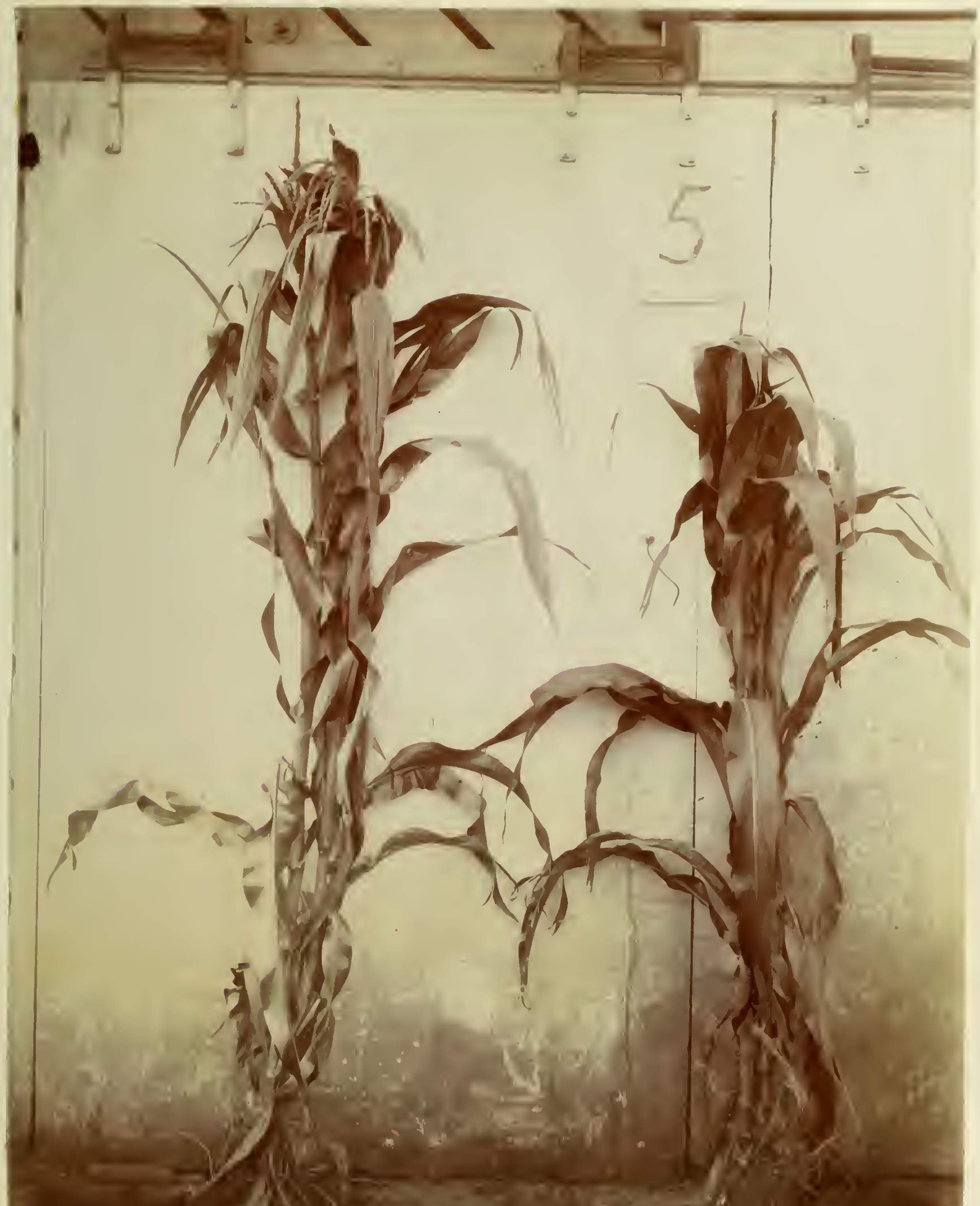

Fig. 5 Not Pruned

Pruned 6 inches [illegible]

It is a somewhat difficult matter to tell by these results just what harm was done by hurting the roots. A glance at the third table where results are averaged will show that in every case but the fourth, sixth, and twelfth fields there was a smaller yield from the pruned rows. Just why there should be a difference equal to six bushels per acre in favor of the rows pruned two inches deep and six inches from the hill is hard to understand, because the pruning in this case did not go much, if any, deeper than the harrow, so the two sets of rows should have yielded very nearly the same. If something besides root pruning caused the difference in this case, the same thing might have produced results in other cases in favor of the unpruned rows. In looking over the first table we occasionally find two unpruned rows only seven feet apart, having a proportionally greater difference, even when the number of ears was the same on both rows, than that referred to above. The plots were located on land that was a little lower than the remainder of the field. After one or two heavy rains the water stood in places on these plots for about a day, and the ground was undoubtedly saturated for a longer period. The damage done by the excessive amount of water was probably not the same on all parts of the plots, so this may account for some variation in the yields of the different rows. From what has been said it would hardly be a valid conclusion that all the root pruning outside of those mentioned did reduce the yield. After having made frequent observations during the growing period and noting the comparative yields, the writer does not hesitate to say that the rows pruned two and four inches from the hill, and those pruned six, eight and ten inches deep were injured to a considerable extent. Of the remainder nothing positive can be asserted, although other experimenters have found that decreased yields resulted from corn

treated in a similar manner. It is true that one year's work under any kind of experimentation does not prove anything. So many factors enter in determining what the growth of the plant shall be, that we are unable to tell what caused this or that result without carrying on the same experiment through several seasons. There are variations in the temperature of the air and soil, in moisture, in plant food, and in the condition of the soil that must be taken into consideration. As was stated above, the reduction in yield would probably have been more noticeable if the season had been dry instead of wet.

Other Work in Root Pruning.

This station has carried on root pruning experiments for a number of years. Below is a table showing comparative results for five years where the pruning was done at practically the same depth and the same distance from the hill.

Year	Treatment						Pruned	Unpruned	Decrease %
1888	3 times	3-4	3 deep	6	from hill		[illegible]4.3 bu.	[illegible]8.9 bu.	[illegible].5%
1889	"	"	4	"	"	"	75.6	86.5	13%
1890	"	"	"	"	"	"	54.4	71	23%
1891	"	"	"	"	"	"	49.4	75.1	35%
1893	"	"	"	"	"	"	70.7	78.3	10.3%
1895	"	"	"	"	"	"	26.5	35.4	24.9%

Later other work was done when the pruning was tried at different depths. For three seasons the average results were about as follows:

Not pruned	65 bu. per acre
Pruned 2 in.	60 " "
Pruned 4 in.	15 " "
Pruned 6 in.	30 " "

The Minnesota Station has published the following table giving the results of their work for three years with root pruning.

1889	Pruned	55 bu.	Unpruned	48 bu.
1890	"	34-1/3	"	36-2/3
1891	"	41-1/3	"	15-1/3

At the Oklahoma Station the same thing was tried but no injury was found where the pruning was three inches deep. At 6 inches deep and from 6 to 12 inches from the hill the yield was materially reduced, but pruning 22 inches from the hill caused no damage.

Conclusion.

It is evident from the above experiments that root pruning generally causes a decreased yield, and the deeper the pruning the greater the loss from the pruned rows. It is not usual for farmers to cultivate deeper than four inches even with the large shovels, and as cultivation cuts the roots only on two sides at one time we need not expect the loss to be as great as in that root pruned on four sides at once. It is probable that cutting the roots does not do as great injury to the corn during a wet season as during a dry one.

ROOT GROWTH

In order to understand the results of these experiments it is well to know something about the manner of root growth in corn. A number of investigators have made a study of this question and their observations generally agree. The plan of the work was to wash out the dirt from the roots of the plant by a stream of water under pressure. Sometimes the seed was planted in a sort of a cage so that when the dirt was washed out the roots would remain about as they were in the soil. The following description of root growth is according to the observations that have been made.

The first root pushes out of the covering of the chit a day or so before the point of the stalk does. The stem grows up vertically through the soil and forms the first leaf whose base is the first node or joint. This node is usually formed from one to two inches below the surface of the soil even when the seed is planted at different depths. If the soil is dry, or ground uneven, it is sometimes necessary to plant deep and in either case there is probably no harm done and nothing gained. The stem between the seed and the first node is more slender and longer, so that the node is as near the surface as if the seed were planted shallow. Ordinarilly two or three inches is about the right depth to plant the seed. While the stem is growing from two to four inches to reach the surface the root increases from five to ten inches in length, and is covered with numerous minute hairs, ready to absorb the plant food with which they come in contact. These minute hairs or sucking cells are only found near the tip of the root. An inch or two from the tip there are found branching or secondary roots that are shorter and more slender than the primary roots. These are also covered with sucking cells. Near the center of the

which two or four other roots begin to grow soon after the first has started, and all of these are called the first or seminal whorl of roots. When the soil is moist and warm near the surface these roots grow outward and very nearly in a horizontal direction from two to four feet. Later when the soil begins to dry they turn down and grow from two to five feet more. When the seminal whorl has grown from six to twelve inches, a second whorl of three to five roots forms at the base of the first leaf and is called the first nodal whorl. These roots have practically the same length and direction as the first whorl. A third whorl starts out after a few days from the second node which is only about one-fourth of an inch above the first node. From the third node grows a whorl of from four to six roots. The fifth whorl has on an average six roots; the sixth, eight roots; the seventh, twelve roots; and the eighth, seventeen roots. These roots are larger in diameter and the nodes are farther apart than were the earlier ones. All of these roots leave rootlets along their line of growth to take up moisture and plant food. The majority of the rootlets are, however, in the first foot or two of soil. The (The) seventh, eighth and ninth whorls generally grow just under the surface of the hill before the plant begins to tassel. About the time of tasseling one or two whorls of brace roots start at or above the surface of the hill. These help to anchor the plant to the ground and may form secondary roots for the absorption of moisture.

The direction taken by the different whorls of roots depends somewhat on the kind of soil, the amount of moisture, and temperature. In spring when the soil is moist and warm on the surface, and cold beneath, the first five whorls tend to grow in a horizontal direction. This may be due also to the large amount of plant food near the surface. After about one month these change

their direction and go nearly vertically downward. The roots of the first two or three whorls usually die before maturity and leave the large ones to supply nourishment. The remainder of the whorls of roots usually take a downward course from the first. It has been found that in a dry spring the roots of the first few whorls strike downward at once also.

The rate of growth differs, of course, with the surroundings. Professor King found that at the end of nine days some of the roots extended to a distance of sixteen inches from the hill and to a depth of eight inches. No roots were nearer than three inches from the surface at six inches from the hill. After eighteen days the roots extended laterally eighteen inches from from the hill and some had reached a depth of twelve inches. None were nearer than two inches from the surface at six inches from the hill. At the end of twenty seven days the greatest depth to which the roots had reached was eighteen inches and some had extended two feet from the hill. When the corn was eighteen inches high, forty two days after planting, the roots had not only passed each other and were about eight inches deep at the center of the row. When the corn was laid by and the stalk was three feet tall, the roots filled the soil to a depth of two feet, and at tasseling they occupied the upper three feet of soil and were within five inches of the surface at the center of the row. Later in the season the leaders were found within four inches of the surface and their rootlets, from four to six inches long, reached almost to the surface of the ground.

At the Colorado Station roots were found thirty days after planting to have extended two and one-half feet deep and three feet from the plant. Later some were traced five feet deep and as far to one side. In black adobe soil the roots were located

mostly in the upper foot of soil, while in the heavy clay soil they grew downward at a moderately sharp angle but the most of them were in the first two feet of soil.

CORN CULTIVATION

The subject of depth of cultivation follows naturally after the consideration of the foregoing phases of corn culture. The experiment station of practically every state whose farmers are engaged in the production of corn has published results of experiments in deep and shallow cultivation. In twenty one of these experiments from different states, eleven gave yields in favor of shallow cultivation, seven in favor of deep cultivation, and in the other four there was no decided difference. This, of course, means very little, if anything, to us. Some of these reports showed unmistakable evidence of a juggling with figures in order to bear out some theory of the experimenter. Some men connected with an experiment station will start experiments with the idea of proving one certain proposition, and they so manipulate the conditions or doctor the results that their previous conclusion is supported. In all experimental work that amounts to anything one out of two or three results should be looked for. For instance, if one were to experiment with depth of cultivation he should not start with the idea of proving that shallow cultivation was best but should make conditions and treatment as nearly alike as possible except in the depth to which he cultivated, and in this case he should look for one of three results: a yield in favor of shallow cultivation, a yield in favor of deep cultivation, or yields so nearly the same that he could not say one depth was better than

the other. Now, the juggling of figures in a report can often be detected by the careful reader, but when the doctoring is done in the manipulation or control of the conditions the reader has no way of detecting this fact. Another fault in experimental work is the drawing of conclusions from too few data. Sometimes advice is given based on one or two year's experience, and when the farmer finds that the same result does not always follow he loses faith in such work. Methods of this kind tend to throw all experimental work into disrepute, because the average intelligent farmer does not know whose results are trustworthy. The time will soon come when the work of no one will be accepted except of those who are widely known as honest, accurate, scientific investigators.

This station conducted a test of ordinary deep and shallow cultivation for five years from 1888 to 1892, in 1896 and in 1903. A brief summary is given below together with the rainfall for the five growing months in each year and the average rainfall for eight years. It will be noticed that in the first two years the rainfall was above the average, and the result favored shallow cultivation. The third year the rainfall was a little below the average and yet the yield favored shallow tillage. The fourth was a very dry season and corn cultivated deep did best as it did also the fifth year when the rainfall was a little above the average for the five months. In 1896 there was very little difference between plats cultivated at different depths although the rainfall was very heavy. Last year deep tillage gave a little larger yields and the rainfall was more than twice the average.

	Cultivation		Rainfall					
Year	Shallow	Deep	May	June	July	Aug.	Sept.	Total 5 mo.
1888	95.3 bu.	84.9	6.84	5.75	5.84	4.14	1.95	23.96
1889	84.6	74.2	5.52	6.81	5.84	0.60	2.77	21.51
1890	66.5	60.8	3.56	3.60	2.83	1.93	1.19	13.31
1891	68.4	63.4	0.39	2.08	1.41	2.36	0.41	7.65
1892	70.1	80.1	7.36	5.36	2.5	2.43	0.93	18.08
1896	63.4	86.3	5.62	2.98	7.87	3.74	5.84	26.05
1902	87.9	89	2.61	10.98	4.7	0.8	4.9	32.99
Average for 8 years			4.22	3.32	3.21	1.94	3.02	15.71

Since good returns come sometimes by shallow and at others by deep tillage it will not be out of place to review some of the reasons that might be given to explain the advantage and disadvantage of both methods. It will be remembered from the statements in regard to root pruning and growth that the entire feeding surface of the roots was confined to the lateral primary and secondary roots for three or four weeks at least, and that some of these roots came within three inches of the surface at six inches from the hill. Now, those who recommend shallow cultivation insist that the cutting of these roots by the large shovels will injure the growth of the plant and reduce the yield. We know that when a root is cut off the new tip can not serve as a mouth for taking up plant food and the feeding surface can be regained only by sending out new secondary roots or enlarging those already present. This undoubtedly takes up energy of the plant that should be used in the production of leaves and stem. However, plants adapt themselves to circumstances very quickly and repair the injury as much as possible, so that if some of the roots are cut the tendency is to make a

more compact root system than would otherwise be formed. This would be detrimental to the plant if the season were dry or if the upper layer of soil were coarse and did not retain sufficient moisture, because the roots could not go deep enough to get the needed water. Another benifit to be derived from shallow tillage is the dust mulch which aids in the conservation of moisture. The part of the soil out of which a mulch is made is the richest on the farm, so the qualities of a good mulch require that it be as thin as possible and yet prevent too great a waste of the soil moisture. If the tool that is used leaves a uniform covering of stirred soil the mulch can be lighter than if the ground has been left in ridges.

An interesting experiment in cultivation was made at the Missouri Station in 1890, where two tenth-acre plots were cultivate shallow and two deep with the following results:

Deep cultivated, average two plots	41.2 bu.
Shallow cultivated, two plots	53.3 bu.

In order to see whether or not the difference was due to root pruning, two other tenth-acre plots were used. One was cultivated shallow and one deep and the corn on both plats was pruned a little deeper than the deep tillage. The yields were:

Deep cultivated, root pruned	48 bu.
Shallow cultivated, root pruned	53 bu.

Since I found but one experiment of this kind no conclusion can be made but the results suggest that there was something else besides root pruning that caused the decrease in the deep tilled plots. There may have been more moisture retained by the shallow culti-

vation, because less soil was exposed than by deep cultivation.

On the other hand the large shovel cultivator is a good tool to use for the destruction of weeds, to loosen up the soil, and to dry the surface during a wet season by increasing the amount of surface from which evaporation can take place. If the weeds are allowed to grow in the corn field they will use plant food and moisture that should be taken by the corn plant, so their presence very likely does more damage than is done by the deep cultivation. When weeds have a good start there is no tool so convenient to handle and as efficient in destroying all kinds of weeds as the large shovel cultivator. Ordinarily a man can keep ahead of the weeds by properly preparing the seed bed but there are times when vigorous means must be used in order to prevent their development. With some kinds of soils on a dry year deep culture is often advisable in the early part of the season to loosen up the soil as deep as possible so that the air and rain will enter readily and pass down to where the feeding surfaces of the roots are. The injury to the roots is probably not very great in this case as they tend to strike downward on a dry year instead of spreading out laterally. If the rainfall is heavy and the soil becomes too wet for the bacteria to do their work, or if the water table is raised and prevents the entrance of air to the root tips then cultivation with large shovels will throw up the surface in ridges and thus expose more soil from which evaporation takes place. As the moisture in the upper few inches evaporated that from below would be drawn up by capillarity and soon conditions would be more favorable for plant growth. This would also be true if the field were not well drained but water should be removed through tile drains if possible, since evaporation cools the soil and sometimes soluble substances are deposited at the surface that are injurious to plant development.

A study of the reports of cultivation at different stations shows that at some places deep culture continually gives better yields, at some shallow cultivation is better, while at others one depth has very little advantage over the other. Now, when various results are obtained in different states where soil and climate are not the same, it is reasonable to suppose that we may reach different conclusions on widely separated farms in this state. It may be that these reports suggest the final conclusion in regard to depth of cultivation, namely, that one depth is not preferable to another in all parts of the state. The temperature is not the same all over the state, there is considerable variation in rainfall of different sections, and a still greater difference in the soils of several localities. The physical condition of soils differs owing to kind of soil, climate, and previous treatment, so that the same methods could not be recommended for two farms unless these conditions were similar. Weeds are more of a nuisance in some localities than in others.

It would be a good plan for some reliable farmers to work out this problem in their own vicinities, and if they find that one depth continually gives better yields than another they should adopt that rather than take the advice of some one who does not know anything about their farms. If they find that one depth give better returns three times out of five, it is not a wise policy to accept the first one, practice it regularly, and run the risk of getting a poor crop two years out of five. It is their business to discover why the second plan worked better during two seasons, and when those conditions are duplicated they should take care that their treatment would produce maximum yields.

Weeds must be destroyed at all hazards, but no kind of subsequent treatment can correct a poor preparation of the seed bed.

If the work is done as it should be most of the weeds will be destroyed before the corn is up. Then the farmer is at liberty to use whatever depth of cultivation he thinks best. Some dirt should be thrown around the hill even with shallow cultivation otherwise the upper whorls of roots will be exposed to the heat of the sun before they get into the soil. The heat may injure the tips so that they are of no use as food gatherers.

Conclusion.

From what has been said it is clear that the question of depth of cultivation is far from being settled. Often the same results are not obtained on one farm year after year, and very different results are found on farms some distance apart. Averages slightly favor shallow culture but some years the deep cultivation gives decidedly better yields, so we can not recommend shallow culture to be practiced exclusively. Both climate and physical condition of the soil must be taken into consideration. A correct preparation of the seed bed is probably of much more importance than depth of cultivation.

Note.- After the above discussion was written a circular was published by this station giving results of last season's work. The table giving yields at several stations in different parts of the state is given below. The remark is often heard that last season was an "off" year and that no reliance can be placed on the results of these tests. It is true that an unusual amount of rain fell last season but it is of greater importance to know

how to raise a large crop on an "off" year than during a normal season. It is not a difficult matter to produce a good crop if the season is favorable but correct information as to the growing of maximum crops on "off" years will be of great value to the farmers of this state. A great many renters lose as much with one poor crop as they gain in two or three good seasons.

Effect of Method of Cultivation.

(Yield, bushels per acre)

Methods used.	Trial No.	Urbana field.	Sibley field.	Bloomington field	Jacksonv'l field	Decatur field	Gen. Ave.
Deep	1	50.2	34.9	77.1	115.3	57.7	
cult.	2	67.8	53.4	86.5	85.3	57.5	
large	3	53.8	76.8	77.4	79.3	....	
shovels	Ave	57.2	56.7	80.3	93.3	57.6	69.0
Medium	1	55.3	42.8	79.1	70.7	56.6	
cult.	2	71.6	71.1	86.1	81.3	53.7	
small	3	74.1	74.9	75.4	70.7	....	
shovels	Ave.	67.1	62.7	80.2	74.2	55.2	67.9
Shallow	1	58.5	40.6	82.2	73.3	52.3	
cult.	2	67.5	69.2	73.4	74.7	....	
weeders	3	67.7	71.1	70.7	67.3	....	
	Ave.	64.6	60.3	75.4	71.7	52.3	64.9

Comments:- These results show some marked differences, but the fact that there is some measure of agreement among the different trials in a given field indicates that one method of cultivation may prove to be best for one type of soil while another may be best for another soil. ....

DETASSELING

In order to understand the work in detasseling it may be well to review a few facts connected with pollination and fertilization in corn. The tassel is composed of a main stem from which branch out a number of laterals. Along both the stem and laterals are borne pods each of which incloses six anthers. These anthers are in sets of threes and the upper set of three ripens a day or so before the lower set. The pollen on the main stem ripens first, a day or two later the upper laterals, and in about two days more the lower laterals. As the pollen ripens, the pods open and the anthers hang suspended by short filaments. The anther is a small narrow tube opening, not at the bottom, but at one side of the lower end as it hangs suspended. This may be a provision in nature to prevent in-breeding. Usually the pollen grains do not leave the anther unless shaken by the force of the wind, and when the force of the wind is sufficient to shake out the pollen it is strong enough to carry it away from the stalk on which it is produced.

While the tassel is forming there appear in the axils of five or six of the lower leaves rudimentary ears, but of these usually not more than one or two develop and they are formed highest up on the stalk. As these rudimentary ears increase in size silks are formed from the crowns of the ovaries or unfertilized kernels. These silks grow toward the tip of the ear and extend out beyond the husks in order to receive the pollen grains. Silks are usually not in a receptive condition until they have been exposed at least one day. If the silks are fertilized they cease to grow and the ends begin to dry, but if no pollen reaches the silks, growth continues as long as the stalk is green and the silk may extend

as much as a foot beyond the husk. When a pollen grain falls on a silk that is receptive a growth from the grain enters the tissue of the silk and passes down to the ovary, and as soon as this takes place the kernel begins to develop. The silks of the butt kernels appear first, then the silks of the remaining kernels in order toward the tip. In some ears the tip silks do not get beyond the husk, while in others they come out from six to eight days after the first silks appeared. In the latter case, most of the pollen has fallen so there is small chance for them to be fertilized.

There are approximately 1000 kernels on a good sized ear and for the fertilization of such an ear, as many pollen grains are required. If the pollen fell vertically down more than 1000 grains would have to fall on one square inch in order to fertilize the ear. The pollen really falls toward the silks, as they hang down, at an angle with the vertical so that more than one square inch of surface is exposed in the direction from which the pollen comes. Suppose that this number of grains should fall on one square inch, then for a surface three feet and six inches square, representing the amount occupied by one hill, there would be required 1,764,000 pollen grains. According to a table given below, a hill of two stalks belonging to the larger varieties would furnish about 50,000,000 grains. Now, making allowance for partly the tassel ripening a day or two before the silks appear and that some of the silks are not out until after the pollen of the stalk has fallen, it is evident that more pollen is produced than is necessary for the fertilization of the kernels. It has been argued that the materials used to form the extra amount of pollen are, in a measure, wasted and that by reducing the amount of pollen produced, a larger ear will be formed. With this idea in view many experiments have been made in which the tassels of every

other row, or of every alternate two rows, were removed, but as yet nothing definite has been proven.

Dr. Mottes of this station has given the following reason to show why detasseling should not be done continuously in the field from which the seed ears are selected. It is well established that pollen grains vary considerably in vigor and in the rapidity with which the pollen tube grows down the silk toward the ovary. When there is a large amount of pollen produced, the chances are that several grains will fall on each silk. Suppose that ten pollen grains fell on a silk and began to grow. Growth would be retarded and slow in those grains possessing little vigor, while the more vigorous grains would send their tubes down quickly, the one growing most rapidly being the one to fertilize the ovary. But there may be only one grain in ten that is vigorous, so if we reduce the amount of pollen by one-half there is less chance of one strong grain falling on each silk to fertilize the kernel. It is quite probable that the kernels fertilized by weak pollen grains will not produce strong, rapid-growing plants, hence if seed be taken from such stalks and the detasseling continue for several years the corn is likely to lose vigor and germinating power. This station is now working in this direction and the results will be watched with interest.

The following experiment was conducted by myself during the past summer. Twenty four rows 210 hills long were used. The tassels were removed by hand from alternate pairs of rows as soon as the tip of the tassel could be seen coming out of the top leaf. As the corn did not tassel evenly it was necessary to to go over the rows seven or eight times at intervals of two or three days. The corn was harvested and weighed November 8th.

Rows	Pounds corn	Decrease
1,2, Detasseled	467	15 lbs.
3,4, Not detasseled	482	
5,6, Detasseled	504	22 "
7,8, Not detasseled	526	
9,10, Detasseled	462	50
11,12, Not detasseled	512	
13,14, Detasseled	484	48 "
15,16, Not detasseled	532	
17,18, Detasseled	508	38 "
19,20, Not detasseled	546	
21,22 Detasseled	502	49 "
23,24, Not detasseled	551	

The table shows a decrease in every case and the average loss on two rows was thirty seven pounds or at the rate of four and one-eighth bushels per acre. Different results might have been obtained if alternate rows had been detasseled, instead of alternate pairs of rows, because the chances for complete fertilization would have been greater.

The work of detasseling has been carried on at several experiment stations with varying results. A common plan was to try the experiment one year, and, if the yields were increased by detasseling, to recommend that the farmers go through their corn and detassel alternate rows. Perhaps the second year no effect was noticed and the third year a decreased yield was obtained by detasseling. The work would then be dropped with the advice that it should not be done by farmers. So far as I know no station has continued the work for more than three or four years except this station. The following table will indicate the amount of work done that has been reported.

State	No. of trials	Crop increased	No effect	Crop decreased	Increase paid for work
N.Y. Cornell	4	3	1		3
Delaware	2	2			2
Georgia	2		1	1	
Kansas	3	1	1	1	1
Maryland	1			1	
Michigan	1	1			
Nebraska	3			3	
Ohio	2		1	1	
South Carolina	1	1			1
Utah	2			2	
Illinois	7	3	2	2	1

In order for the work to be effective it is necessary that the tassels be removed before the pollen is formed. The proper way to do this is to pull by hand as soon as the tip of the tassel appears. Sometimes the last leaf comes away with it but this leaf is small anyway so that its removal does not materially injure the plant's development. A part of those who made the above experiments went along and cut off the tassels with a corn knife. In this case either the tassels were well out and the pollen already formed, or several of the upper leaves would be removed. If the pollen had developed before the tassel was removed no increased yield could be expected, while if several leaves were cut off an actual decrease might reasonably follow. Hence the reports from the different stations do not give a fair idea of the merits or defects of the practice.

It has been estimated that the cost of detasseling amounts to about a dollar to a dollar and a quarter per acre. This would

require an increase of from three to five bushels per acre to pay for the work done. In the last table it will be seen that only ~~seven~~ eight out of twenty eight experiments paid for the labor of detasseling.

So far as I know the effect of different seasons on the development of pollen has not yet been worked out. This is an important and may throw light on the varying results thus far obtained by detasseling. It has been observed that on one year there is formed a small amount of pollen in comparison with the amount on another year, but just what effect is produced by the sun, moisture, heat or wind is not known. If this information were at hand the farmer might be able to judge with a reasonable degree of certainty whether he should detassel or not, since the time of appearance of the tassel is only five or six days earlier then the time of ripening of the pollen.

Conclusion.

From the results thus far obtained detasseling can not yet be recommended as a general practice.

SUCKERS AND BARREN STALKS

Last summer I noticed that the suckers were very numerous on a piece of sod ground. There were suckers in almost every hill, and where there was only one stalk in a hill it was not uncommon to find three and sometimes four suckers. Figure 6 shows a stalk with five suckers. In order to find out whether the presence of these suckers would reduce the yield,ten rows a hundred hills long were left alone and from the next ten all suckers were removed. It was thought best to use several rows together rather than only one or two for comparison,for then the appropriation of moisture and plant food by the suckers would be more noticeable. The yields were:

Rows	Treatment	Pounds	Bu.per acre.
10	Not touched	1590	74.4
10	Suckers removed	1530	71.5

This shows a loss of nearly three bushels per acre by removing the suckers. This difference is not large enough for a definite conclusion.

Very little information has been published in regard to the effects of removing the suckers from the plant soon after they appear. A number of years ago the experiment was tried at the Kansas Station and the work was repeated in 1889 with similar results. The yields from the last experiment were as follows:

Rows	Treatment	Ears	Nubbins	Rate of yield
8	Suckers removed	87.62 lbs.	9.12 lbs.	59.40 bu.
8	Untreated	88.57 "	14.23 "	63.14 "

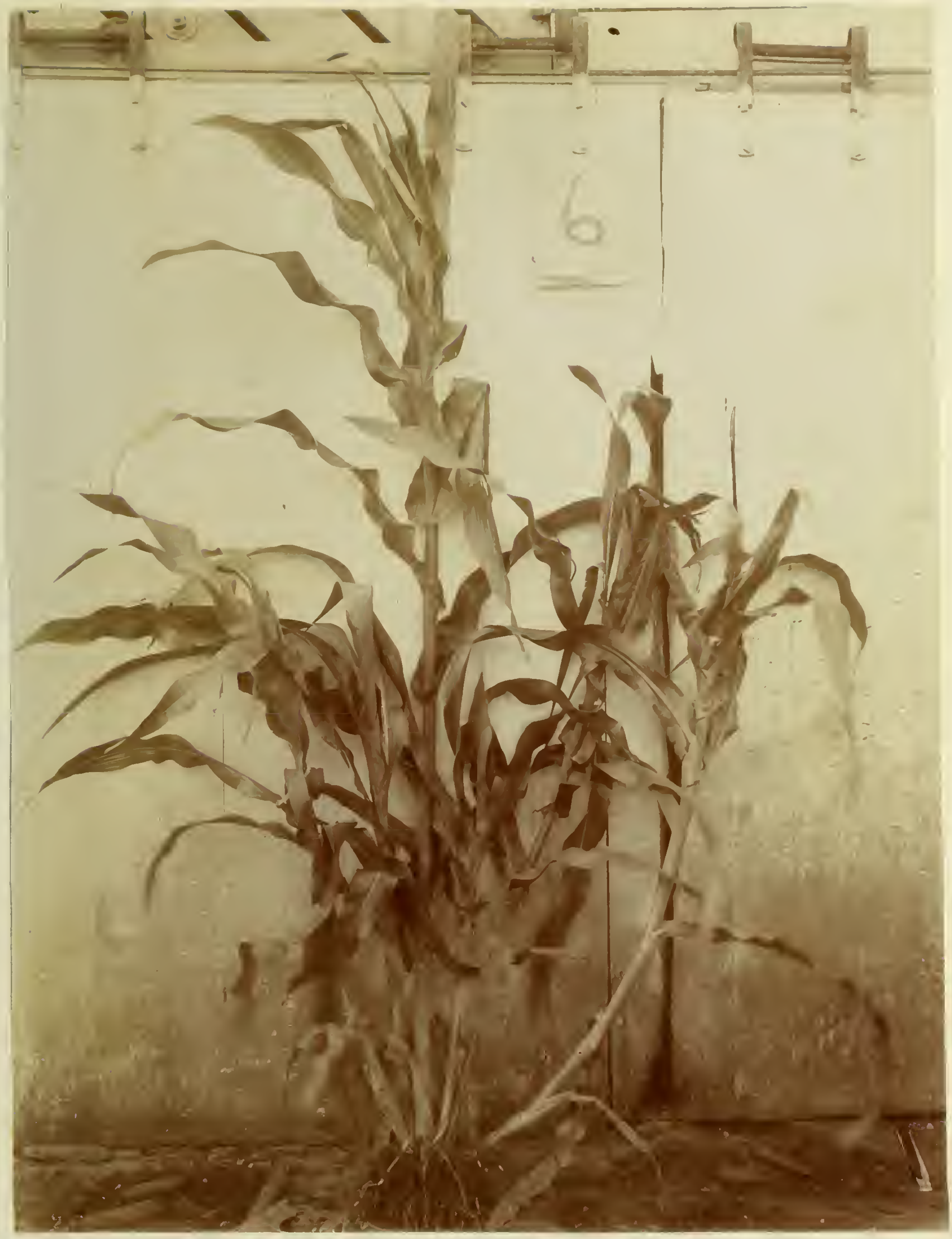

Fig. 6. A stalk with some suckers.

Each one of the eight rows was next adjacent to one of the rows not treated. The investigator comments on the results by saying that"the removal of suckers was a positive loss to the crop in every respect save one. The yield per acre of the suckered rows was five bushels less than that obtained in the adjacent untreated rows, and there was a corresponding loss in the yield of each plant. The quality of the corn yielded on the suckered rows was markedly superior to that obtained from the other specially treated rows. It was better than that obtained from the untreated rows and greatly superior to the product of the detasseled and topped rows which were frequently very poor. The reason for the superiority of the corn obtained from the suckered rows is easily explained by the absence of the lateral shoots and the consequent small ears which they bear."

Advice is often given to farmers to go through their corn and pull out the suckers or to detassel the suckers before the pollen is ready to fall. The reason given for pulling the suckers is that they require nourishment from the parent plant which should be using the plant food and moisture in its own growth and in the development of an ear. Careful observations have not been made by myself during a number of seasons but from what I have seen during the past year on different kinds of soil I am lead to believe that suckers are more numerous where there is an abundance of plant food and during a season favorable for a large rapid growth. A sudden checking of growth by hot dry weather will also start them. A sucker starts at, or a little below, the surface of the ground and soon develops a root system of its own. As the roots are being formed the sucker becomes less and less dependent on the parent for nourishment, and, when three or four feet in height, is almost detached from the plant. Since the sucker has both a root system

and a leaf surface of its own the injury to the parent plant can not be very great on a favorable year. These shoots may even lock up plant food that would otherwise be lost. If the suckers begin to grow and the season turns dry, then the loss of moisture through the suckers might reduce the yield of the parent plants.

The reason given for detasseling the suckers before pollination takes place is based on the supposition that the kernels fertilized by the pollen of suckers have low vitality and do not produce strong vigorous plants. But I noticed last season that the tassels of suckers did not ripen usually until after the pollen from the main stalks had fallen. In estimating the number of pollen grains in each, it was very difficult to find a plant and its sucker, both of which had ripe pollen. Now, it is a well known fact that the pollen of fertile stalks falls before the tip silks are out, so that often the only way in which these silks can be pollinated is by the pollen from the suckers. The tips of the ears are usually discarded in planting so no harm can come from them and there may be an increased yield on account of the presence of the suckers.

An Indiana farmer reported that"one season a drouth came at a time to develop numerous suckers. A second drouth while not preventing tasseling and formation of some pollen, checked earing. This was followed by a continuation of the very best corn weather, forcing the silk-covered cobs far beyond the husks. But where was the fertilizing pollen to come from? Not from the tassels of the original stalks for they were dead or exhausted. This proved to be a case where it was not best to interfere with nature by destroying the suckers, for they were numerous enough to furnish sufficient pollen and at the right time too to make a full crop. A few acres of the corn planted with corn crib seed and averaging about one stalk per hill had more suckers than original stalks and

[illegible]

[illegible]

[illegible]

fully seventy five per cent of the suckers had fair sized ears on the side of the stalks instead of grain tassels as is usual."

Conclusion.

Removing suckers from the corn plant is not analogous to the pruning of branches from fruit trees, since suckers are dependent on the parent plant only until they have developed a root system of their own. Except in corn raised for seed where quality is desired, it is doubtful whether it pays to pull the suckers or to detassel them.

Barren Stalks.

A few years ago a large per cent, almost one-third of the stand, was reported from different parts of the state as being barren and the idea was started at once that the barrenness was the result of pollen from barren stalks fertilizing the kernels used for seed. The attempt was made to breed out the barren stalks by detasseling them and according to count the attempt was apparently successful. During the past year, however, reports from different fields where no attempt was made to breed out barrenness show the number to be very small, probably not over two or three per cent. This would indicate that barrenness was not due to heredity but to unfavorable conditions of climate, lack of moisture and plant food, or too many stalks to the hill.

TASSELING AND SILKING OF CORN

No very definite statements have been published in regard to the time of tasseling, of ripening of the pollen, and of the appearance of the silks. Statements are found in books on corn culture that the tassel ripens and allows the pollen to fall before the silks can be seen. Other writers assert that the tassel ripens and silks appear about the same time. If the first statement is true there is no chance for in-breeding by natural pollination, while if the second statement is true this might occur. It is doubtful if in-breeding ever occurs to any considerable extent because the pollen does not fall unless the tassel is shaken, and then it does not usually go vertically downward. In order to determine the facts for the past year, observations were made of ten representative stalks of each of seventeen varieties grown on the experiment station farm. This work began the twenty third of July, and observations were made and changes recorded every morning until the eighth of August. The first column is the number of the stalk; the second the date in July when the tassel appeared; the third, the date on which the main stem of the tassel ripened. The remainder of the tables will be readily understood from the headings. Some of the tassels were out before the observations began and this fact is shown by the star.(*) By tip silk is meant that from the last three-fourths inch of cob.

The last row of figures in each table represents the average relative time of the change in development counted from the day the top of the tassel ripened. For instance, in Johnson County White the day of ripening of the top tassel is called one, then the third day following, the middle of the tassel ripened, and between the fourth and fifth days the lower part of tassel ripened. The second day the butt silks appeared, etc.

Johnson Co. White, L.B.Clore

1	23	27	30	31	27	0	29	4	1
2	23	23	30	2	31	0	1	3	2
3	24	1	1	3	3	0	4	0	6
4	24	29	31	3	1	0	3	6	4
5	*	29	30	30	30	31	31	4	1
6	24	29	31	1	30	0	31	8	2
7	23	27	30	31	23	0	29	5	1
8	23	29	31	*1	28	31	29	4	1
9	23	27	29	31	27	27	29	0	1
10	24	30	1	2	2	0	3	0	4
		1	3	4½	2	2½	3½	6½	5½

Silver Mine, F.A.Warner

1	*	25	27	29	25	0	28	2	29
2	*	25	27	30	25	27	27	1	30
3	*	25	27	29	26	0	28	1	30
4	*	24	27	29	25	26	27	4	30
5	*	29	27	30	26"	0	1	4	1
6	*	24	27	31	25	27	26	1	31
7	*	28	29	31	30	0	31	4	3
8	*	25	27	29	23	29	29	7	1
9	*	27	23	31	26	23	29	4	31
10	*	25	28	30	30	0	1	7	4
		1	3	5	2	3	4	10	7

Boone Co. White, J.O.Foland

1	23	31	2	3	1	0	2	0	4
2	24	31	1	2	1	0	2	7	6
3	24	30	30	31	31	0	3	3	5
4	*	27	23	31	29	0	1	5	4
5	*	25	27	30	25	27	29	3	31
6	*	24	27	30	27	0	23	6	1
7	24	29	31	2	30	0	2	6	5
8	24	27	30	31	29	30	30	5	2
9	*	25	29	31	28	0	30	6	1
10	*	31	31	2	Barren				
		1	3	5½	2½	3½	4½	9	7

Burrs White, L.Griswold

1	*	26	23	31	31*	0	1	5	3
2	*	*	24	27	23	0	29	1	1
3	23	26	27	29	25	31	27	2	30
4	*	*	24	27	25	0	26	2	30
5	*	24	27	29	25	0	27	2	30
6	*	27	23	30	25	27	27	1	30
7	*	24	27	30	25	26	27	1	29
8	*	25	27	29	27	0	29	4	31
9	*	24	26	27	27	27	29	0	31
10	*	24	26	30	26	0	27	1	30
		1	3	5½	3	3½	5	10	7

Banner White, J. R. Ratekin

No. of Stalk	Tassel	Top Ripened	Middle Ripened	Lower Lv. Ripened	Silk	Silk	Middle Silk	Top	
1	*	25	27	29	31	25	27	30	30
2	*	24	25	23	25	27	26	31	31
3	*	24	27	29	25	0	29	3	1
4	23	23	23	30	23	23	29	4	31
5	*	24	27	30	23	0	27	1	31
6	*	24	25	29	26	28	23	2	31
7	*	23	28	31	26	0	23	3	31
8	*	27	23	30	26	0	30	5	1
9	*	*	21	23	25	26	27	0	30
10	*	24	26	23	27	23	30	3	31
		1	2½	5	2	3½	4	9	7

Leaning, H. E. Chester

No. Stalk	Tassel	Top	Middle	Lower	Silk	Silk	Middle	Top	
1	*	24	25	30	27	0	28	3	1
2	*	26	27	30	28	0	29	3	1
3	*	24	25	29	30	0	1	6	2
4	24	23	30	31	29	31	30	6	1
5	*	24	27	29	30	0	31	6	2
6	*	21	27	29	25	0	27	2	30
7	*	27	23	31	27	0	28	2	31
8	*	27	23	31	29	0	31	6	1
9	*	*	21	27	25	27	27	2	30
10	*	24	25	2[illegible]	26	29	26	2	31
		1	2½	5½	3½	5	5	11	7½

Peerless White, J. R. Overstreet

1	24	29	31	1	30	0	2	3	2
2	24	31	31	3	31	0	2	6	3
3	24	29	31	1	31	0	1	7	3
4	23	23	29	31	28	0	2	0	3
5	23	28	31	1	31	0	1	6	4
6	23	23	31	1	31	0	1	5	4
7	23	27	28	30	1	0	2	5	4
8	*	24	27	29	27	23	28	4	31
9	*	25	27	23	23	30	30	4	1
10	*	*	24	27	25	0	23	2	31
		1	3	4½	3	5	5	10	7

Reil's Yellow Dent, J. L. Reil

1	24	30	31	2	31	0	1	4	2
2	24	30	31	2	3[illegible]	2	1	6	3
3	*	24	27	30	27	0	23	3	31
4	24	23	29	1	28	30	29	4	1
5	*	27	23	29	27	28	28	1	31
6	*	25	27	29	29	0	31	6	2
7	23	27	29	31	2[illegible]	0	30	0	2
8	24	30	30	31	29	29	30	3	2
9	23	27	23	1	27	29	29	6	1
10	24	[illegible]	29	30	30	3	1	6	2
		1	2	4½	2	3	3½	3½	6

Pride of the North, F. A. Warner

No. of Stalk	[illegible] appeared	Top Ripened	Middle Ripened	Lower Tas. Ripened	Silk appeared	Silk of 2nd ear	Middle silk	Tip silk	Silk began to dry
1	*	24	27	28	23	24	25	29	28
2	*	25	27	29	26	0	27	2	30
3	*	26	28	30	25	26	27	2	30
4	*	25	27	28	24	0	27	1	29
5	*	24	25	28	23	26	27	2	30
6	*	*	24	25	30	0	1	3	3
7	*	27	28	29	25	27	27	2	30
8	*	*	24	27	25	0	27	4	30
9	*	25	26	28	25	27	27	1	29
10	*	23	25	27	23	0	26	0	29
		1	3	4½	1½	2	4	9	3½

Golden Eagle, H. B. Perry

No. of Stalk	[illegible] appeared	[illegible] Ripened	Middle [illegible]	Lower Tas. Ripened	Silk appeared	Silk of 2nd ear	Middle silk	Tip silk	Silk began to dry
1	*	24	25	27	25	0	26	2	29
2	*	26	28	30	27	28	29	4	31
3	*	27	28	31	28	0	29	2	1
4	*	24	27	28	26	28	28	4	29
5	*	23	25	28	28	24	27	29	28
6	*	23	25	27	27	28	29	4	31
7	*	24	25	29	25	26	27	3	30
8	*	25	27	28	27	0	28	3	31
9	*	23	25	27	28	26	27	31	29
10	*	*	*	23	23	0	26	29	29
		1	3	5	2	½	4½	10	6½

Riley's Favorite, Jas. Riley

1	24	28	28	31	28	29	29	3	31
2	23	26	28	30	28	0	29	4	1
3	23	28	31	31	28	0	29	4	1
4	25	Broken by wind July 30							
5	24	26	28	30	26	29	26	1	31
6	*	24	26	27	27	0	29	5	1
7	23	27	28	30	28	30	29	2	1
8	*	27	28	30	29	0	30	3	2
9	*	24	25	27	27	0	28	1	31
10	24	28	31	2	30	0	1	4	2
		1	2½	4½	2½	3	4	3½	6½

Calico, Funk Seed Co.

1	24	27	28	30	26	0	29	4	1
2	23	28	30	31	27	30	29	3	31
3	24	29	30	31	27	28	28	3	31
4	25	1	3	6	2	0	3	7	5
5	24	27	28	30	26	25	26	1	29
6	*	27	28	30	27	0	28	3	31
7	23	27	30	31	26	26	28	3	31
8	*	25	27	30	27	0	29	2	31
9	*	24	25	28	25	0	27	1	30
10	25	28	31	2	28	0	29	3	1
		1	3	4½	1	1	2	7	5

Groves Golden Dent, Funk Seed Co.

No. of Stalk	Tassel appeared	Top Ripened	Middle Ripened	Lower Tas. Ripened	Silk appeared	Silk of 2nd ear	Middle silk	Tip silk	Silk began to dry
1	*	25	27	28	27	0	28	1	1
2	*	28	26	26	25	0	27	1	30
3	24	28	29	1	29	0	30	4	1
4	*	27	28	31	28	0	28	1	31
5	23	27	28	31	30	0	31	3	1
6	*	24	25	28	28	0	29	2	1
7	*	24	25	26	27	0	28	3	1
8	*	27	28	31	26	25	27	31	30
9	24	27	30	31	30	0	30	4	1
10	24	29	31	2	31	0	2	5	4
		1	2	4½	2½+2		3½	3	6

Gold Mine, B. ?. Wyman

No. of Stalk	Tassel appeared	Top Ripened	Middle Ripened	Lower Tas. Ripened	Silk appeared	Silk of 2nd ear	Middle silk	Tip silk	Silk began to dry
1	*	26	27	30	27	0	28	2	1
2	*	24	25	28	24	0	27	31	29
3	*	*	24	28	24	0	27	31	29
4	*	*	24	27	25	25	27	2	30
5	*	*	24	27	24	0	26	30	30
6	23	27	28	30	28	0	29	4	1
7	*	24	25	28	28	0	29	1	2
8	*	25	27	28	25	0	27	5	30
9	*	24	26	28	25	25	27	29	29
10	*	26	26	29	25	26	26	29	30
		1	2	5	2	2	½	3	7

Pride of Nishna, J.R.Ratckin

No. of Stalk	Tassel appeared	Top Ripened	Middle Ripened	Lower Tas. Ripened	Silk appeared	Silk of 2nd ear	Middle silk	Tip silk	Silk began to dry
1	*	26	28	31	27	0	28	2	31
2	*	27	31	2	31	0	1	7	4
3	*	27	30	31	31	0	2	4	4
4	*	27	28	30	31	0	1	6	2
5	*	25	27	29	25	26	27	4	31
6	*	24	27.	28	26	0	26	4	1
7	23	28	30	1	1	0	2	7	4
8	*	*	24	26	27	0	29	3	1
9	*	24	25	28	30	27	31	0	31
10	24	30	1	2	31	0	2	4	3
		1	3	5	4	·3	5½	10	3

90 Day, Funk Seed Co.

No. of Stalk	Tassel appeared	Top Ripened	Middle Ripened	Lower Tas. Ripened	Silk appeared	Silk of 2nd ear	Middle silk	Tip silk	Silk began to dry
1	*	26	27	29	26	28	28	1	31
2	24	27	29	31	29	29	30	7	1
3	24	27	28	31	28	28	29	2	1
4	23	26	27	30	26	26	27	1	29
5	23	27	29	31	28	30	29	2	1
6	*	23	26	27	25	26	28	1	30
7	*	*	24	28	23	0	26	1	30
8	*	*	*	24	25	0	27	4	31
9	*	26	28	29	25	0	27	1	30
10	23	28	31	1	30	0	31	5	3
		1	3	5	2	3	3½	3	6

Mastadon, Funk Seed Co.

No. [illegible]	[illegible] eared	Top ripened	middle ripened	butt ripened	Silk appeared	silk [illegible] 2nd [illegible]	middle silks	Tip silks	silk began to dry
1	*	27	28	30	26	0	23	6	31
2	24	23	31	1	31	0	1	7	3
3	23	31	31	1	31	0	1	7	3
4	23	31	31	2	2	0	3	0	4
5	*	27	28	30	26	27	28	1	30
6	*	*	24	27	*	0	25	25	29
7	*	24	25	29	25	23	25	31	29
8	24	25	27	29	29	26	23	4	1
9	*	24	25	28	30	0	1	6	3
10	*	24	25	30	30	0	3	7	4
		1	2	4½	3	2	4½	10½	7

A study of these tables shows that the middle of the tassel ripens about the second or third day after the top ripens, and the lower part is all ripe before the sixth day. The silk appears once in a while before the pollen begins to fall but usually about the second or third day after the top of the tassel ripens. The middle silks are out a day or two after the butt silks appear. The tip silks, however, do not usually get beyond the husks until from six to eleven days after the first pollen has fallen, and two or three days after the lowest pollen has gone. In most cases the first silks began to dry before the tip silks appeared.

Number of Pollen Grains.

Below is a table giving approximately the number of pollen grains in a fertile stalk, a sucker and a barren stalk. The first part of the table represent tassels taken from a stalk and its sucker. The tassel of the barren stalk was taken from the same hill as the fertile stalk unless the other tassels in that hill were unusually small, when the fertile stalk was chosen near by. The pollen grains were poured or shaken from the anther into narrow rows on a glass slide. The slide was then passed under the low power of the microscope and the grains were counted. The number of grains in an anther on the main stem did not differ much from the number in an anther of the lateral branches.

Variety	Stalk	Pods on tassel	Pollen in anther	Pollen grains in tassel. Approx.
Boone Co. White	Fertile	2093	2527	31,734,000
" "	Sucker	1939	1733	20,601,000
Leaming	Fertile	1756	2387	25,151,000
"	Sucker	1742	2209	23,033,000
Silver Mine	Fertile	1189	2354	16,795,000
" "	Sucker	1630	1257	12,670,000
Reid's Yel. Dent	Fertile	1671	1893	18,979,000
" " "	Barren	2000	2150	25,320,000
Boone Co. White	Fertile	1958	2938	34,515,000
" "	Barren	2974	2316	50,248,000
Silver Mine	Fertile	1558	2284	20,565,000
" "	Barren	2355	2554	35,325,000
Johnson Co. White	Fertile	2189	2284	28,394,000
" " "	Barren	2381	2554	41,665,000

SUMMARY

1. Root pruning did not show as marked effects last year as on ordinary years. That pruned two and four inches from the hill and that pruned six, eight, and ten inches deep was injured to a considerable extent. On the other work there was not enough difference to support any conclusions. Generally root pruning lessens the yield and the deeper the pruning, or the closer to the hill, the greater is the loss on the pruned rows.

2. The first four or five sets of roots grow in a horizontal direction from two to four feet, then turn down and grow from two to five feet more. The later whorls of roots go down at a rather sharp angle from the first.

3. It is probable that the same depth of cultivation is not best for all kinds of soil, owing to differences in climate and in the physical conditions of the soil.

4. From present data detasseling can not be practiced with the assurance of securing an increased yield sufficient to pay for the labor of detasseling.

5. Removing suckers may be of advantage on a dry season or where quality is desired, but on ordinary years it is probable that they do not do any great harm. Barren stalks may be the result of a lack of nourishment.

6. The silks of corn usually appear one or two days after the top of the tassel ripens. The tip silks do not often appear until all of the pollen has fallen from the tassel.

7. From a table given it is evident that a fertile stalk has considerably more pollen than its sucker, and a barren stalk has almost one-half more than an average fertile stalk.